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ABSTRACT

This paper discusses various theories of the role of memory in vocabulary acquisition and storage. Several research models are described, and theoretical considerations and questions are presented. The lexicon is seen as an element of grammar; an understanding of lexicon organization is important in the understanding of vocabulary acquisition. Research into memory and vocabulary development has implications for the foreign language teacher. (VM)

THE MENTAL LEXICON: VOCABULARY ACQUISITION AS A PROBLEM OF LINGUISTICS AND OF HUMAN MEMORY

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There has been little evidence of research interest in foreign language vocabulary learning during the three decades preceding the present one.[1] Emphasis in foreign language education, both in research and in the classroom, has been on the acquisition of phonological and syntactic systems and, in general, on the initial stages of language learning where the role of vocabulary learning is held to be secondary (Rivers, p. 17).

Recent directions in linguistics and in the field of human memory suggest, however, that the problem of vocabulary learning may be both more serious and more interesting than has been supposed. Similarly, theories of cognitive and language development provide some basis for a deeper appreciation of this problem for the foreign language learner.

During the years in which psychological research was dominated by the behaviorist approach, as exemplified in the work of B. F. Skinner (1956), and linguistics by structuralism, vocabulary acquisition was often treated as a somewhat complex case of stimulus-response learning and hence a not very interesting process. The re-evaluation of this position stems from the work of Chomsky (1957, 1959) in the area of linguistics and a turn from behaviorism in psychology. Today, no area of language, nor in fact of any human cognitive activity, is regarded simply as a question of stimulus and response. If the rich result of this change in orientation provides no real alternative view of how vocabulary is learned, it has made very clear that in this activity too an individual does not just perform a stimulus-response type of learning. If vocabulary acquisition is also considered as a cognitive activity and, in particular, as a problem of memory, some insight may be gained at least into how very complicated the process of acquisition may be.

First of all, it is necessary to consider how the knowledge that a language speaker possesses may be economically characterized. Transformational grammarians have argued that this knowledge is ideally expressed by a system of rules which allows a speaker to comprehend or to generate an indefinitely large number of sentences. The generative

grammar has been assumed to be representative of this system although transformational grammarians insist a generative grammar is not a model for a speaker or listener. Chomsky (1965) conceives of this generative grammar as having three major elements: the base component, a semantic component, and a transformational component. King (1969, p. 17) illustrates how such components might be arranged in a grammar with the sketch contained in Figure 1. The lexicon which represents the word store of the language is also represented in the center of the model.

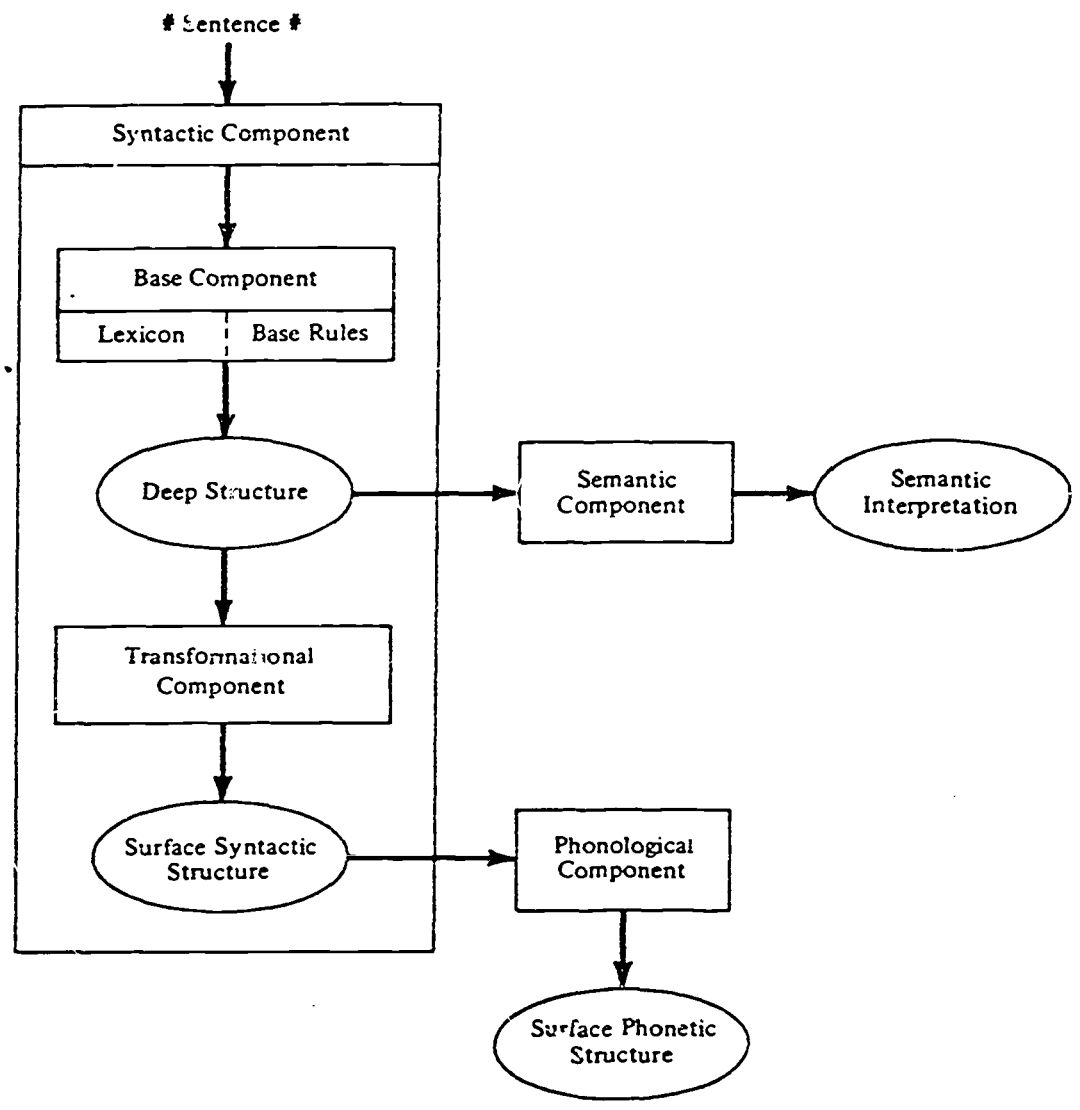

Figure 1. Organization of a Transformational Generative Grammar. (Robert D. King, Historical Linguistics and Generative Grammar; reprinted by permission of Prentice Hall, Inc., Englewood Cliffs, New Jersey, copyright 1969, p. 17.)

What information must be contained in this lexicon? Given that the grammar of the language has the form suggested, certain specific kinds of lexical information would be required. This information is usually seen as falling into three sets of representations corresponding to three basic divisions in grammar (Chomsky, 1965, p. 214; Bower, 1970, p. 43) giving a phonological, syntactic, and semantic representation for each word. King (1969) thus says: "A partial statement of such information for each morpheme would be the redundancy-free underlying phonological shape expressed as a matrix of distinctive features, its syntactic category, information required for the semantic interpretation of the sentence, any individual peculiarities that make the morpheme violate constraints normally placed on morphemes of its general type" (pp. 17-18). One important concept in this description is that the information in the lexicon is non-redundant. That is, any information which could be supplied by other components of the grammar, whether phonological, syntactic, or morphological, need not be shown. This would mean, for example, that the majority of nouns in the lexicon could be entered as morphemes; plural forms need not be specified in most instances since these are rule derivable. A second important concept in King's description is that of distinctive features. The term "distinctive features" stems from members of the Prague school of linguistics who used it in analyzing sound units beyond the level of the phoneme (Lyons, 1968, p. 120). For example, the feature "voice" is used to distinguish phonemes such as p, t, k (voiceless) from those such as b, d, g (voiced). Such distinctions are often expressed in a matrix using + or - symbols to represent the presence or absence of a feature. To illustrate what a partial listing of the phonological features of a word would entail, King gives us the representation of the word divinity shown in Figure 2.

Syntactic and semantic information may be expressed similarly. Katz and Fodor (1963, pp. 412-415) have suggested that possible semantic information for the word bachelor (meaning an unmarried man) might be represented by such features as + (human), + (male), + [one who never married].[2] There are difficulties in utilizing the notion of distinctive features in a semantic theory. Although it has seemed possible--but by no means certain--that phonological and syntactic features might be finite and possibly universal in nature, a correspondingly limited set of semantic features seems quite impossible.

A recent paper on developmental psycholinguistics by Slobin (1970) which is heavily influenced by Piagetian-type cognitive analyses draws attention to a truism relative to the child's language development which is nonetheless very important in the consideration of lexical expansion: "More and more features are added to lexical items, and more and more rules are added for handling the co-occurrence restrictions on features. The acquisition of selectional constraints on the use of individual lexical items continues through childhood. . . . But note that a form never enters

d	i	v	i	n	+	i	+	t	y
+ segment	+ segment	+ segment	+ segment	+ segment	− segment	+ segment	− segment	+ segment	+ segment
− vocalic	+ vocalic	− vocalic	+ vocalic	− vocalic	+ formative boundary	+ vocalic	+ formative boundary	− vocalic	− vocalic
+ consonantal	− consonantal	+ consonantal	− consonantal	+ consonantal	− word boundary	− consonantal	− word boundary	+ consonantal	− consonantal
− sonorant	− back	− sonorant	− back	+ sonorant		− back		− sonorant	− back
− continuant	+ high	+ continuant	+ high	+ coronal		+ high		− continuant	
+ coronal		− coronal	+ tense			− tense		+ coronal	
+ anterior		+ anterior						+ anterior	
+ voice		+ voice						− voice	

Figure 2. Phonological Representation of Divinity in the Lexicon. (Robert D. King, Historical Linguistics and Generative Grammar; reprinted by permission of Prentice Hall, Inc., Englewood Cliffs, New Jersey, Copyright, 1969, p. 20.)

in a void; that is to say, something about its general use is correct. . . . Time words can be used in syntactically appropriate contexts before they are understood. The child can learn to put a word of a given class in position without fully understanding its content. . . . Forms are not completely developed when first used" (p. 16). In considering lexical development, several aspects of the lexicon problem become evident. First, general mechanisms of storage and use, whatever form these may have, are probably developed in the same manner and rate as the grammar of the language. Just as the generative system of the grammar may be distinguished from the individual sentences it generates, the framework of the lexicon may be similarly differentiated from the individual entries in the lexicon. The framework of the lexicon may include such things as the system of storage and recall and a system of rules for simplifying entries. Thus, when it is maintained that the lexicon remains flexible long after the adult grammar seems to have solidifed (King, 1969, p. 67; and Carroll, 1960, p. 338), it is the addition or expansion of individual entries that exhibit change rather than the system. The overall system of the lexicon is probably as stable as the other components of the grammar. Initial stages of vocabulary learning in a foreign language probably involve alterations in the system itself, however, and is thus more complex than realized.

The capacity to add and change individual lexical entries brings the lexicon into view as a memory problem. How are the entries stored? They appear to consist of a list or list capacity of bits of information. These bits are both highly abstract and very large in number. Furthermore, the entries are interrelated and a change in one individual item may affect numerous other entries. What might be the nature of a system allowing such changes and alterations? Lexical entries, whatever their form, are ultimately memory entries, and the problems of lexical storage (learning a word) and retrieval (production or recognition of a word) are among the most interesting of memory problems.

One of the fruitful ways of looking at memory has been in relation to information processing models (Norman, 1969; Reitman, 1966). An introductory understanding of such models may be gained by considering a simplified sketch of a computer system as shown in Figure 3. The basic elements of the system are: input, process, storage, and output. To make a highly simplified analogy with this system for language, input may be regarded as either a string of sounds or as an idea and the processor as the translator or producer of the language with the storage, or memory system, containing all the various rule components and the lexicon. The processor draws upon the relevant components of the generative grammar and the necessary lexical information from storage, operates upon the input, and outputs either the interpretation or a speech reply depending upon the nature of the input.

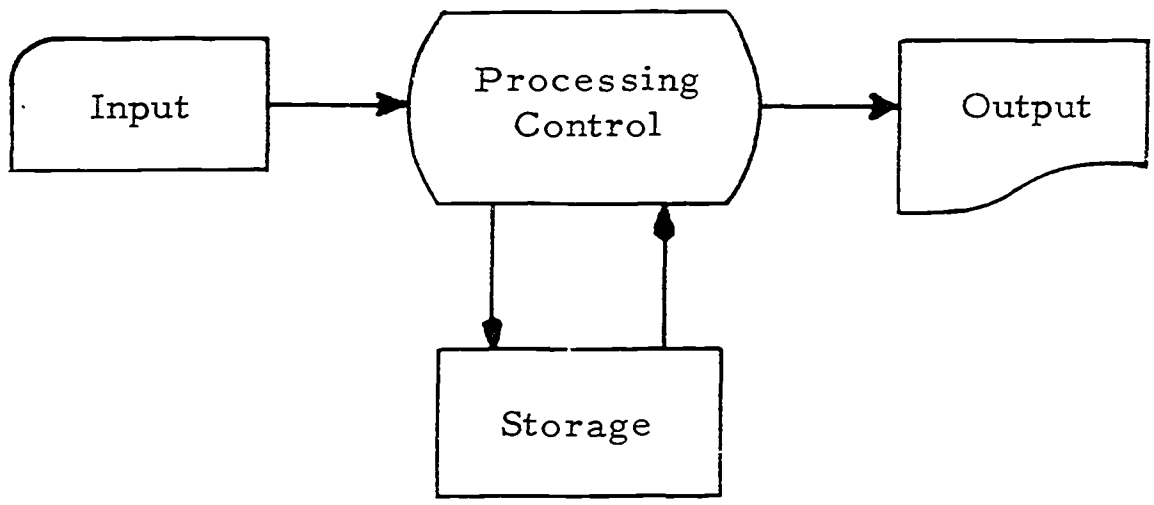

Figure 3. Functional Components of a Computer System. (Donald J. Veldman, Fortran Programing for the Behavioral Sciences; reprinted by permission of Holt, Rinehart and Winston, New York, copyright 1967.)

Reitman (1966) provides the following description of one type of computer memory: "Memory is built up of elementary units, each of which is capable of changing or being changed under some conditions, and of remaining unchanged for some period under others. Much as on a sheet of graph paper, these elementary units are organized into larger units. Each of these larger units, called cells, occupies a specific memory location. This location is designated by an internal symbol . . . which serves as the name of the cell occupying the corresponding fixed location in the memory of the computer" (p. 264). It may be seen that such a memory model would have several desirable features insofar as the lexicon is concerned. Addition would be easy, changes might be made, organization is present.

This memory model could, however, also handle another complication of memory, that is, that storage and retrieval mechanisms postulated for the lexicon should optimally also be operative on other kinds of materials which also must be in memory storage. Guilford (1965, p. 86), for example, reminds us that memory holds, in addition to semantic information, many other types such as symbolic, visual, and behavioral.

Miller (1969) has discussed various possibilities for the organization of semantic lexical information in memory and concluded that the best basis would be some combination of the semantic marker system and a predicate hypothesis. The distinctive feature concept is again convenient for the information processing model. Brown and McNeill (1966) in their imaginative investigation of the "tip of the tongue" phenomenon, a label

for a state in which "complete recall of a word is not presently possible, but felt to be imminent," induced this state in a group of subjects by presenting definitions of low frequency words and asking the subject to supply the word. The kinds of accurate information which the subject supplied about the word without being able to specify the word itself were the data of interest. This data fell into the following categories: The number of syllables, the initial letter, syllabic stress, and letters in other than primary position. Brown and McNeill (1966) draw on an analogy to illustrate the relevance of these findings: "The problem begins with a definition rather than a word and so S must enter his dictionary backwards, or in a way that would be backwards and quite impossible for the dictionary that is a book. It is not impossible with keysort cards, providing we suppose that the cards are punched for some set of semantic features" (p. 333). They continue to suggest that retrieval would be based on these features. Retrieval would operate rather like thrusting metal rods into the holes in the cards and fishing up the collection of entries. Such retrievals then provide the key to the phonological shape of the word in question. Several other memory phenomena might also be explained by such an approach. As Bower (1970, p. 43) points out, word associations might be determined by the cue and response words sharing some subset of such semantic features. Explicit or implicit directions (such as, give opposites, clang associates, synonyms, etc.) could be used to pre-set output so that different sets of associates could be elicited. Rhyming pairs, on the other hand, or words beginning with the same sound would be recalled through shared phonological features. Even syntactic categories might be recalled on such a programming basis.

Although one of the primary functions of the lexicon is undoubtedly the provision of information to the sentence-producing mechanism, this is not its only function. For example, information from the lexicon must also be available to the visual system. Not only can a person translate objects in his visual field into words through "naming," he can also form mental images for both words and sentences. That is, a subject asked to form a mental image of a green square can actually perform this task to his satisfaction (in most cases) and profess a mental image in the absence of any visual stimulus (Shephard and Chipman, 1970, pp. 1-17). It would seem likely that either some information necessary for this task must be coded with the words in question or, more likely, that the visual or imaging capacity can avail itself of lexical representations in their existing form. This carries significance for language in that there is speculation that memory for sentences may be stored in a semantically abbreviated form along with directions for its reconstruction (Bobrow, 1970). Further speculation has been that this storage often assumes the characteristics of an image (Paivio, 1969).

Other memory phenomena pose difficult problems for a theory of lexical organization. Why are some words learned after only one exposure and others not after many exposures? What, for example, is there

in the nature of concrete words that makes them easier to learn and recognize in paired associate tasks than abstract words? (Paivio, 1965) And congruently, why are specific words easier to learn than general words? (Paivio and Begg, 1964) Has this a relationship to the way words are stored? Bower (1970) hypothesizes that hierarchical grouping is natural to information storage and retrieval. Do such effects then illustrate some sort of hierarchical organization in the lexicon? If we postulate hierarchical organization, how do we reconcile this with the kind of organization suggested by experiments in other areas? For example, Oldfield and Wingfield (1965) found that response latencies for naming objects (when presented with outline drawings) vary with the frequencies of occurrence of the words in the language. A possible lexical organization compatible with these findings would be based on some kind of ordering process on the basis of frequency in language use.

This discussion can, of course, touch on only a very few questions raised by the available linguistic and memory data, but perhaps it has been sufficient to illustrate how the problems of these areas interweave with those of the study of word acquisition. The lexicon is obviously an element in a grammar, and how one views its acquisition should certainly be a function of how grammar in general is viewed. Any theory of vocabulary acquisition which fails to take into account theories of memory will be sadly deficient.

What does this research say to the foreign language teacher? The most important message of current research is that vocabulary acquisition is important. It is important in all stages of language learning and especially in advanced stages. Lado (1967) has recently demonstrated that vocabulary acquisition can go on far more rapidly than it ever does in most classrooms.

Another important message in current work in linguistics and psychology is that vocabulary learning is extremely complex. More research is needed at both a theoretical and a practical level. Theory can enrich our understanding of the lexicon, but practical research can even now improve instruction. I have argued elsewhere (Holley, 1971) that too many of our current classroom practices, especially in the area of vocabulary instruction, are based on hearsay and intuition rather than research knowledge. Since the lexicon plays such a key role in the communication of meaning which is, after all, the ultimate goal of language, its formation deserves both kinds of research attention.

Finally, I believe that the need for language instruction premised on multi-sensory learning is once more demonstrated. Comenius' belief in the Seventeenth Century that language is learned through all the senses is borne out in the research of today. There is a visual component to our word knowledge just as there is a sound component. The fuller our experience of a word, the more complete the lexical entry in the mental lexicon.

NOTES

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2. Fodor and Katz maintain that distinguishing between the specifications in parentheses and brackets is necessary. The features in parentheses are labeled semantic features and serve to express the regularities holding between words in the language. The bracketed features, termed distinguishers, reflect idiosyncratic aspects of the word. Several writers have disputed the distinctions they propose. There is, in fact, much current controversy over the semantic component of the grammar. While Fodor and Katz raised the possibility that this component might be susceptible to such treatment as other components of the generative grammar were receiving, subsequent papers have raised more questions than they have provided answers.

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